

## CHAPTER 18

### HEARING CONSERVATION AND NOISE ABATEMENT

#### 1801. Discussion

a. Hearing loss has been, and continues to be, a source of concern within the Navy, both ashore and afloat. Occupational hearing loss resulting from exposure to hazardous noise, the high cost of related compensation claims, and the resulting drop in productivity and efficiency highlight a significant problem that requires considerable attention. Noise control and hearing conservation measures contribute to operational readiness by preserving and optimizing auditory fitness for duty in Navy personnel.

b. Reference 18-1 contains the hearing conservation program for forces afloat.

c. Reference 18-2 describes the Department of Defense (DoD) hearing conservation requirements. Reference 18-3 is a Navy Environmental Health Center technical manual. It provides supplemental guidance concerning medical department procedures in support of the Hearing Conservation Program.

#### 1802. Hearing Conservation Program Introduction.

The goal of the Navy hearing conservation program is to prevent occupational hearing loss and ensure auditory fitness for duty in the military and civilian workforce. The program includes the following:

a. Noise Measure and Analysis. Survey work environments to identify potentially hazardous noise levels and personnel at risk

b. Engineering Control. Reduction of noise at the source is in the best interest of the Navy and its personnel. Environments that contain or equipment that produces potentially hazardous noise will, whenever it is technologically and economically feasible, be modified to reduce the noise level to acceptable levels as established by this chapter. Section 1810 of this chapter provides specific guidance on noise abatement

c. Hearing Protective Devices. The use of personal hearing protective devices to limit noise exposure should only be an interim protective measure while implementing engineering controls. Where engineering controls are not feasible, activities shall employ administrative controls and/or the use of hearing protective devices.

d. Audiometry. The cognizant medical treatment facility shall conduct periodic hearing tests that will allow activities to monitor the effectiveness of the hearing conservation program. Early detection of temporary threshold shifts allows further protective action to be taken before permanent hearing loss occurs. Necessary follow-up evaluation will be conducted to ensure appropriate referral, treatment and early return to duty.

e. Education. Individuals exposed to hazardous noise, their supervisors, and people providing hearing conservation services (i.e., training, monitoring, hearing protection, etc.) will receive training. Training these individuals is vital to the overall success of a hearing

conservation program. An understanding of the permanent nature of noise-induced hearing loss, its negative effects on operational readiness and individual fitness for duty, the command's hearing conservation program, and the individual's responsibilities under the program are all essential for program effectiveness. Also, activities shall encourage all Navy employees to use hearing protective devices when exposed to hazardous noise during off-duty activities, e.g., from lawn mowers, chain saws, firearms, etc.

### **1803. Navy Occupational Exposure Limit (NOEL)**

The following section gives the NOEL for occupational exposure to noise:

- a. For an 8-hour time-weighted average (TWA) of 84 decibels on the A-weighted scale (dB(A)) for frequencies of 20 to 16,000 Hertz (Hz))
- b. For periods of less than 16 hours in any 24-hour period, calculate the NOEL from the following equation:

$$T = \frac{16}{2^{\frac{L-80}{4}}}$$

Where:

T = time in hours (decimal)  
L = effective sound level in dB(A)

#### **NOTE:**

When two or more periods of noise exposure of different levels comprise the daily noise exposure, their combined effect must be considered. If the sum of the following expression exceeds unity (i.e., >1), then the mixed exposure exceeds the NOEL.

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \dots + \frac{C_n}{T_n}$$

Where C indicates the total time of exposure at a specified noise level and T represents the time of exposure permitted at that level.

- c. For impact or impulse noise 140 dB peak sound pressure level
- d. When TWA exposures are greater than 84 dB(A), activities shall include personnel in the Navy's Hearing Conservation Program.

### **1804. Noise Measurements and Exposure Assessments**

In order to effectively control noise, it is necessary to accurately measure noise according to standard procedures and properly evaluate the measurements against accepted criteria.

- a. Noise measurements shall be taken as part of the industrial hygiene survey.

(1) An IH, industrial hygiene technician, exposure monitor, occupational audiologist or other individual suitably trained by an IH is authorized to take noise measurements.

(2) Sound level meters shall conform, as a minimum, to the Type II requirements cited in reference 18-2. Suitably trained personnel shall use an acoustical calibrator, accurate to within plus or minus one decibel, to calibrate the instrument before each survey and to revalidate the calibration at the conclusion of the survey. Suitably trained personnel shall calibrate sound level meters and sound level calibrators electro-acoustically annually.

(a) Suitably trained personnel shall measure continuous or intermittent steady state noise with a sound level meter set for dB(A) scale, slow response.

(b) Suitably trained personnel shall measure impact or impulse noise as dB peak sound pressure level with an impact noise analyzer.

(3) In cases where circumstances such as high worker mobility, significant variations in sound levels, or a significant component of impulse noise make area monitoring generally inappropriate, suitably trained personnel shall conduct personal dosimetry. Personal noise dosimeters shall meet the requirements in reference 18-2.

Work environments where ultrasound is produced and hearing protection is not already used shall conform to the ultrasound exposure limits set forth in reference 18-2.

(4) Work environments found to have noise levels greater than 84 dB(A) (continuous or intermittent), or 140 dB peak sound pressure level for impact or impulse noise, shall be analyzed to determine the potential hazard and shall be resurveyed within 30 days of any significant modifications or changes in work routine which could impact/alter the noise intensity/exposure level.

(5) Suitably trained personnel shall conduct all noise measurements taken to determine an individual's exposure with the microphone of the measuring instrument placed at a height that most closely approximates the position/location of the worker's ear during normal working conditions. Work-centers may require repeat measurements during a single day and/or on different days of the week to account for the variations in noise level due to changes in operational schedules and procedures.

(6) The record of noise measurements shall be retained per the requirements of chapter 8 of this manual and include, as a minimum:

- (a) The number, type and location of the noise sources
- (b) Number and identification of personnel in the work area and their daily noise exposure and duration
- (c) Type, model, serial number of test equipment and calibration data
- (d) Location, date and time of noise measurements
- (e) Noise levels measured and hazard radius

(f) The name and signature of the person(s) who made the study.

(7) Personnel may record noise survey data on NEHC Forms 5100/17 and 5100/18.

b. TWA noise exposure assessments shall be determined for all personnel routinely working in hazardous noise areas and performing hazardous noise operations. These assessments are complex tasks that shall be performed by an IH or other person that an IH or audiologist judges to be competent. A complete analysis may require the use of octave band analyzers, recorders, and other specialized acoustical instrumentation such as personal noise dosimeters. The exposure assessment will identify which work areas, processes, and equipment produce hazardous levels of noise, determine the type of hearing protection necessary, and identify personnel at risk so they can be included in the hearing conservation program.

(1) Paragraph 1803 outlines the criteria used to determine the degree of compliance with applicable standards.

(2) Designate hazardous noise areas based on the following criteria:

(a) Any work area where the A-weighted sound level (continuous or intermittent) is or is reasonably expected to be greater than 84 dB(A)

(b) Any work area where the peak sound pressure level (impulse or impact noise) exceeds or is reasonably expected to exceed 140 dB.

(3) In the absence of a qualified professional's assessment and documentation to the contrary, activities shall consider personnel at risk if routinely exposed to sound levels greater than 84 dB(A), or for impact or impulse noise, 140 dB peak sound pressure level. These individuals shall be identified on a roster or equivalent database for inclusion in the hearing conservation program. Although this chapter requires hearing conservation measures when noise levels are greater than 84 dB(A), the implementation of all available measures may not be necessary in every case. For example, activities shall require visitors to a hazardous noise area to wear protection, but would not require visitors to have their hearing tested or be included on a roster of noise-exposed personnel. There may also be unique situations where sound levels rise unpredictably to greater than 84 dB(A) or above for short durations so that the wearing of hearing protective devices may be judged impractical or unnecessary. Activities shall document decisions to waive the use of hearing protective devices; such professional judgments shall be rendered by an IH or other qualified professionals, using approved instrumentation and considering all relevant factors.

(4) Determinations to exclude individuals who are already included in a hearing conservation program will be made only by professionals qualified to provide or evaluate noise exposure assessments. In no case will activities exclude individuals already included in a program based upon exposure assessment alone without concurrence from an audiologist or physician trained in occupational hearing loss. Such concurrence is necessary to avoid exclusion of personnel who are noise susceptible or at exceptional risk due to pre-existing hearing loss. Personnel who use hearing aids shall not use them in place of approved hearing

protectors. Hearing aids may not be used in conjunction with hearing protective devices except as approved by an audiologist or otolaryngologist on a case-by-case basis.

(5) Activity follow-up of exposure assessments shall include, as a minimum, the following elements:

(a) Identification of those responsible for designating work areas or equipment as noise hazardous

(b) Identification of individuals exposed to hazardous levels of noise, updating this roster at least semi-annually

(c) Identification of the medical facility responsible for audiometric monitoring

(d) Identification of those responsible for training personnel in the elements of the hearing conservation program.

(6) Activities shall notify each employee exposed to an 8-hour TWA of greater than 84 decibels of the results of the exposure assessment.

#### **1805. Labeling of Hazardous Noise Areas and Equipment**

Activities shall label designated hazardous noise areas and equipment that produce sound levels greater than 84 dB(A) or 140 dB peak sound pressure level. NAVMED 6260/2, Hazardous Noise Warning Decal, 8"x10.5" - NSN: 0105-LF-004-7200, and the NAVMED 6260/2A, Hazardous Noise Labels (displayed on hand tools), 1"x1.5"- NSN: 0105-LF-004-7800, are the approved decals and labels for marking hazardous noise areas or equipment. Equipment and/or power tools may be individually and permanently marked via a stencil (painted) or engraved with the words "Produces Hazardous Noise" or via the NAVMED 6260/2A, Hazardous Noise Warning Decal. To minimize foreign object damage, flight line tools may be stenciled as noise hazardous in lieu of the approved label. Alternatively, a prominently posted sign at the point where the tools are checked out stating that, "Certain Tools May be Noise Hazardous" may be used, provided that the IH survey or similar authoritative, detailed information is maintained readily available nearby for employees to consult on the noise levels produced by the particular tool they are about to use.

a. Activities shall not post an entire building as a hazardous noise environment unless nearly all areas within the building are designated hazardous noise areas.

b. Military combatant equipment is excluded from this labeling requirement. Personnel operating and maintaining combat equipment, however, must be made fully aware of hazardous noise exposure conditions.

c. Activities shall have the option of using additional means to alert employees to noise hazard operations. These may include posting barriers or using flashing lights to indicate hazardous noise conditions exist

1806. Hearing Testing and Medical Evaluation

Activities shall enter all Navy personnel, military and civilian, except those specifically excluded under paragraph 1804b, who are required to work in designated hazardous noise areas or with equipment which produces or is reasonably expected to produce exposure levels at or above an 8-hour TWA of greater than 84 dB(A) or with impulse exposures exceeding 140 dB peak sound pressure levels, into a hearing conservation program. Hearing conservation measures and medical evaluations of hearing tests shall be per the detailed procedures set forth in reference 18-3.

a. (Baseline) Hearing Tests

(1) All military personnel shall receive a reference-hearing test, recorded on a DD 2215, upon entry into naval service. Hearing tests performed at Military Entrance Processing Stations shall not be used as reference audiograms. All civilian personnel being considered for employment in an occupational specialty or area that involves routine exposure to hazardous noise shall receive a reference- hearing test. All reference hearing tests shall be preceded by at least 14 hours without exposure to hazardous noise. This requirement may not be met by wearing the appropriate hearing protective device. Reference hearing tests will not be conducted if there is evidence of a transient medical condition that would affect hearing thresholds.

(2) Navy employees presently in service who do not have a reference audiogram filed in their health record shall not be assigned to duty in a designated hazardous noise area involving exposure to hazardous noise until a reference- hearing test has been performed.

b. Monitoring Hearing Tests

(1) All personnel routinely exposed to noise in excess of the NOEL, and others determined to be at risk, shall be included in the hearing conservation program, have a reference (DD 2215) hearing test in their record and receive periodic monitoring hearing tests. Hearing tests shall be conducted at least annually thereafter for as long as the employee remains in a noise hazardous environment. Monitoring hearing tests shall also be conducted when there are individual complaints of hearing difficulties, e.g., difficulties in understanding conversational speech or a sensation of ringing or fullness in the ear(s). Follow-up evaluation shall be provided to assure appropriate referral, treatment and early return to duty.

(2) The monitoring audiogram shall be compared with the reference audiogram to determine if a significant threshold shift (STS) has occurred relative to the reference audiogram.

c. Exclusion From Future Noise Exposure. Activities shall consider individuals who exhibit a progressive series of permanent threshold shifts to be at high risk for further hearing deterioration. Accordingly, such personnel must be given special consideration under the hearing conservation program.

(1) Individuals monitored under the hearing conservation program who have their reference audiogram redefined due to worsening hearing on three separate occasions, or have hearing loss in both ears in which the sum of thresholds at the frequencies of 3000, 4000 and

6000 Hz exceeds a total of 270 dB, must obtain clearance from an audiologist, otologist or occupational medicine physician before returning to duties involving hazardous noise.

(2) If such clearance is inappropriate, the audiologist or medical officer in charge of the hearing conservation program will make specific recommendations to the individual's command. These may include the advisability of restriction from noise hazardous work, appropriate placement of the worker and/or the need for stricter enforcement of hearing protection policies.

d. Disposition Following Monitoring Hearing Tests. Per reference 18-3, the amount of threshold shift considered to be significant is defined to be 15dB or greater in any frequency 1000 to 4000 Hz in either ear. In addition, a change in hearing of an average of 10dB or more at 2000, 3000 and 4000 Hz in either ear shall be considered a significant threshold shift. Navy recordable STSs shall be reported to the occupational safety and health (OSH) office for entry on the Log of Navy Injuries and Occupational Illnesses. STSs are considered Navy recordable when an audiologist, otologist, or occupational medicine physician confirms the shift is toward deteriorated hearing, is permanent, and is consistent with an occupational origin. In addition, all monitoring results should be reviewed for evidence of an "OSHA recordable" STS, which is defined as a 25dB average change toward poorer hearing at 2000, 3000, and 4000 Hz. Finally, the individual and his or her supervisor shall be notified of either event per 18-2 and 18-3. (See chapter 14 paragraph 1409 for additional details)."

e. Termination Hearing Test. Military personnel shall receive a hearing test upon termination of Navy service. Civilian personnel who have been routinely exposed to hazardous noise or have previously demonstrated a significant threshold shift, shall receive a hearing test upon termination of employment. Additionally, all personnel dropped from the hearing testing program due to removal from hazardous noise duties will have a termination test to document auditory status at the time of reassignment.

#### **1807. Personal Hearing Protective Devices**

a. Hearing protective devices shall be worn by all personnel when they enter or work in an area where the operations generate:

- (1) Sound levels greater than 84 dB(A)
- (2) 140 dB peak sound pressure level or greater.

b. A combination of insert type and circumaural types of personal hearing protectors (double protection) shall be worn when sound levels exceed 104 dB(A) unless an occupational audiologists, IH, or occupational medicine physician has determined that single protection is adequate for the anticipated duration of exposure.

c. All personnel exposed to gunfire in a training situation or to artillery or missile firing, under any circumstances, shall wear hearing protective devices.

d. The determination of which hearing protective devices or combination of devices is suitable for use in each situation, is the responsibility of the IH, audiologist, occupational medicine physicians or other competent personnel, under their supervision. Appendix 18-A

contains information on hearing protection devices and selection criteria. Every effort shall be made to issue personal hearing protective devices suited to the location and duration of usage. Personal hearing protective devices should reduce effective sound levels to less than 84 dB(A) or 140 dB peak. Appendix 18-A lists recommended hearing protective devices available through the Navy supply system. The Navy Environmental Health Center (NEHC) website (currently at <http://www-nehc.med.navy.mil>) identifies additional hearing protectors that have been tested by DoD activities, and are approved for open purchase. Activities desiring to use hearing protective devices not specified in appendix 18-A or cited by NEHC shall submit a sample of the device with a request for evaluation to the Chief, Bureau of Medicine and Surgery (BUMED). BUMED will review manufacturers' test data and conduct additional evaluation as necessary to determine suitability for use.

e. In cases where hearing protection devices alone do not provide sufficient attenuation to reduce the employee's effective exposure at or below an 8-hour TWA of 84 dB(A), administrative control of exposure time will be necessary. Appendix 18-B contains a table of noise exposure limits.

f. Personnel may use custom earplugs only if they cannot be properly fitted with approved hearing protectors or if special circumstances require a custom hearing device. Activities shall provide preformed or custom molded musician's earplugs to service band members. Only audiologists, otolaryngologists or trained medical technicians may take impressions of the ear necessary to make custom earplugs.

#### **1808. Training**

a. Personnel identified for inclusion in the hearing conservation program must receive initial and refresher training per appendix 6-A. Initial training will be provided before assignment to duty in a designated noise hazardous area involving exposure to hazardous noise. Refresher training can be given by local medical personnel at the time of the annual audiogram. The cognizant medical activity shall document the training in the medical record with appropriate notification to the OSH office. The activity OSH office shall maintain records of such training per chapter 6.

b. All Navy personnel included in the hearing conservation program shall receive appropriate instruction in:

- (1) The elements of and rationale for a hearing conservation program
- (2) Proper wearing and maintenance of hearing protection devices
- (3) The command program and individual responsibilities
- (4) Off-duty practices which will aid in protecting their hearing
- (5) Individuals responsibility in protecting their own hearing

(6) How hearing loss affects employability, retention, job performance and career progression.



c. Activities shall provide instruction to all personnel upon reassignment to a new job that is noise hazardous.

#### **1809. Recordkeeping**

a. Activities shall record results of hearing tests performed for hearing conservation purposes, as well as exposure documentation, and these records shall become a permanent part of an employee's health record. The medical department shall retain the original reference audiogram as a permanent part of an employee's health record along with all disposition results and referral notations. The medical department shall record all hearing test results on DD 2215, *Reference Audiogram*, or DD 2216, *Hearing Conservation Data*, as appropriate. The medical department shall place the original in the health record and upload a digitized copy to the Defense Occupational Environment and Health Readiness System-Hearing Conservation (DOEHRs-HC) data warehouse. Those few medical departments that do not have DOEHRs equipment should contact NEHC for guidance. NEHC will no longer accept hard copy forms.

b. The medical department shall retain all noise measurement data, as well as audiometric records and information in an employee's health record per the provisions of Chapter 8, and record the results of noise exposure assessments in the work location block on the DD 2215s and 2216s.

#### **1810. Noise Abatement Program Introduction.**

The primary means of protecting Navy personnel from hazardous noise shall be through the application of engineering controls. Administrative controls (i.e., the adjustment of work schedules to limit exposure) are also effective but often result in some loss in productivity. Personal protective equipment (PPE) (ear plugs, muffs, etc.) shall be the permanent solution only when activities determine engineering or administrative controls infeasible. Chapter 5 discusses general hazard (including noise) control techniques in more detail; therefore, this chapter will address only specific concepts.

#### **1811. Preventive Measures**

It is less costly to eliminate potential noise problems in the design or procurement stage for new processes, equipment, and facilities than it is to make retrofits or modifications after the fact. References 18-3 through 18-8 provide guidance to meet this objective.

#### **1812. Abatement of Existing Noise Hazards**

a. Abatement Methods. The activity shall undertake the abatement of hazardous noise levels, to the extent possible or practicable, by one or more of the following methods:

(1) By engineering design to eliminate or reduce the noise levels of machinery, equipment and other operating devices/facilities to acceptable levels

(2) By damping the noise by means of lamination, mufflers, mountings, couplings, supports, insulation or application of acoustic materials

(3) By acoustical enclosure of the noise producer

(4) By isolation of the noise producer to a point where the noise will affect fewer personnel

(5) By substitution of a less hazardous process

(6) By administrative controls which limit exposure (i.e., control of work schedules).

b. Engineering control feasibility studies. Activities shall initiate studies for those areas where continuous noise levels exceed 100 dB(A) and personnel are exposed for 4 hours or more even though protected by hearing protective devices. Only when activities determine that the methods outlined above are infeasible shall they consider the utilization of personal hearing protective devices a permanent means of control. Activities shall support such determinations by appropriate documentation signed by the cognizant IH and the cognizant engineer and maintain records of such determinations. See chapter 1 for a discussion of exceptions for military unique equipment and operations.

### **1813. Responsibilities**

The Navy assigns the following responsibilities to provide sound and effective occupational noise control and hearing conservation throughout the Navy.

a. The Chief, Bureau of Medicine and Surgery (BUMED) shall:

(1) Centrally manage the hearing conservation program and periodically update the program to maintain currency and effectiveness.

(2) Provide audiometric support to all military and civilian personnel.

(3) Provide subject matter expertise and technical review, and provide/document refresher hearing conservation training in conjunction with the annual audiogram.

(4) Provide appropriate professional and technical hearing conservation guidance and assistance to the Chief of Naval Education and Training (CNET).

(5) Develop guidelines and issue certification for:

(a) Personnel conducting sound level measurements

(b) Personnel performing hearing conservation audiometry

(c) Audiometric test chambers

(d) Audiometers

(6) Establish and maintain a hearing conservation database to measure program effectiveness and use prevalence of hearing loss to provide input to noise control engineering decisions.

(7) Support a research and development effort in the medical aspects of hearing conservation.

(8) Provide assistance in the identification and quantification of noise hazard sources.

b. Headquarters Commanders shall:

(1) In coordination with BUMED, provide technical assistance and engineering guidance to subordinate commands per section 1810.

(2) Consider, design, and engineer noise control features into all (both existing and future) ships and aircraft, weapons and weapon systems, equipment, materials, supplies and facilities.

(3) Provide appropriate technical and engineering control methodology guidance and assistance to CNET.

c. Commanding Officers for shore activities shall ensure that:

(1) All Navy areas, worksites, and equipment under their cognizance, identified as noise hazardous are labeled and where necessary, suitably trained personnel shall conduct surveys and assessments.

(2) Activities institute a hearing conservation program where a potential noise hazard has been identified per section 1804 and maintain a roster of personnel placed in the program.

(3) Activities, in cooperation with the cognizant medical treatment facility, annually evaluate hearing conservation program effectiveness as specified in 18-2.

(4) Activities eliminate or reduce hazardous noise levels through the use of engineering controls.

(5) Activities provide personal hearing protective devices, and ensure proper usage by personnel where administrative or engineering controls are infeasible or ineffective.

(6) All military and civilian personnel, whose duties entail exposure to potentially hazardous noise, receive instruction per this chapter.

(7) Emphasis is placed upon leadership by example regarding the wearing of hearing protective devices. Activities shall enforce policy, including the initiation of disciplinary measures for repeated failure to comply with the requirements of the hearing conservation program.

## Chapter 18

### References

- 18-1. OPNAVINST 5100.19D CH-1 of 30 Aug 01, Navy Occupational Safety & Health (NAVOSH) Program Manual for Forces Afloat (NOTAL)
- 18-2. DODI 6055.12 of 22 Apr 96 Hearing Conservation Program
- 18-3. NEHC Technical Manual TM 6260.51.99-1 of May 99, Navy Medical Department Hearing Conservation Program Procedures
- 18-4. NAVFAC P-970 of 15 Jun 78, Environmental Protection Planning in the Noise Environment
- 18-5. MIL HDBK-1008 (C) of 10 June 1997, Fire Protection for Facilities for Engineering Design and Construction (NOTAL)
- 18-6. Army TM-5-805-4 of May 95, Noise and Vibration Control
- 18-7. NIOSH Pub. No. 79-117, Industrial Noise Control, latest edition, (NOTAL)
- 18-8. MIL-STD-1472F, Human Engineering Design Criteria for Military Systems, Equipment and Facilities, latest edition, (NOTAL)

**Appendix 18-A**  
**Hearing Protective Devices**

Manufacturer's Nomenclature/NSN	Type of Protector	Federal Nomenclature
Ear Defender V-51R 6515-00-442-4765 6515-00-467-0085 6515-00-467-0089 6515-00-442-4807 6515-00-442-4813	Insert Earplug (sized) 24's (sized) 24's (sized) 24's (sized) 24's (sized) 24's	Plug, Ear, Noise Protection (X-Small) (White) (Small) (Green) (Medium) (Int'l Orange) (Large) (Blue) (X-Large) (Red)
Comfit, Triple Flange 6515-00-467-0092 6515-00-442-4818 6515-00-442-4821	Insert Earplug (sized) 24's (sized) 24's (sized) 24's	Plug, Ear, Noise Protection (Large) (Blue) (Regular) (Orange) (Small) (Green)
Silaflex (Blister Pack) 6515-00-133-5416	Non-Hardening Silicone	Plug, Ear, Noise Protection Cylindrical, Disposable 200's
EAR or Deci-Damp 6515-00-137-6345	Foam Plastic Insert	Plug, Ear, Noise Protection Universal Size, Yellow 200 pr
Straightaway Muffs 4240-00-759-3290 4240-00-674-5379 4240-00-979-4040	High Performance Circumaural Muffs For 9 AN/2 For 9 AN/2	Aural Protector Sound 372-9 AN/w Replacement Filter, Dome Replacement Seal, Dome
Ear Plug Cases 6515-01-212-9452 6515-01-100-1674	Non-reflective	Case, Earplug 12's Case, Earplug 20's
Sound-Ban 6515-00-392-0726	Headband, Earcaps	Plug, Ear, Hearing Protection, Universal Size
Circumaural Muff 4240-99-691-5617	Type I Overhead Headband	Aural Protector, Sound
Circumaural Muff 4240-00-022-2946	Type II Napeband (for use with hard hat)	Aural Protector, Sound

## POSITIVE AND NEGATIVE FEATURES OF HEARING PROTECTION DEVICES

Type	Positive	Negative	Duration
<u>Insert</u> V-1R Triple Flange	After adaptation can be used for long periods. Relatively inexpensive.	Individual fittings by medical personnel required. Frequent fitting causes irritation.	Long-term (3 - 4 hours)
<u>Disposable</u> Silaflex, EAR or Deci-Damp	Comfortable. Individual fitting not required. Relatively inexpensive	Molded by hand. Easily Soiled. Difficult to clean.	Infrequent use. Transitory noise exposure.
<u>Circumaural</u> <u>Muffs</u> Type I and II 372-9 and AN/2	May be worn over plugs. Most efficient universal device.	Expensive. Heavy. Difficult to carry. Hair or eyeglasses may reduce effective ness.	Long or short term

One single type of hearing protective device will not meet the needs of all personnel in a hearing conservation program. Activities shall select the appropriate type of hearing protection device based upon a consideration of the factors listed above in addition to the degree of attenuation required in a particular situation. The most convenient method of making this determination is the Noise Reduction Rating (NRR) developed by the Environmental Protection Agency (EPA). The NRR is usually shown on the hearing protector package. The NRR is then related to an individual worker's noise environment in order to assess the adequacy of the attenuation of a given hearing protector.

Since there are a wide variety of noise measuring instruments in use, personnel conducting sound level measurements shall use one of the following methods. In each case, they should take a sufficient number of measurements to achieve a representative noise sample.

a. When using a dosimeter that is capable of C-weighted measurements:

(1) Obtain the C-weighted dose for the entire work shift, and convert to TWA sound level (see dosimeter instruction manual for conversion table).

(2) Subtract the NRR from the C-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

b. When using a dosimeter that is not capable of C-weighted measurements, the following method may be used:

(1) Convert the A-weighted dose to TWA (see dosimeter instruction manual)

(2) Subtract 7 dB from the NRR value.

(3) Subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

c. When using a sound level meter set to the A-weighting network:

(1) Obtain the A-weighted TWA.

(2) Subtract 7 dB from the NRR and subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

d. When using a sound level meter set on the C-weighting network:

(1) Obtain a representative sample of the C-weighted sound levels in the environment.

(2) Subtract the NRR from the C-weighted average sound level to obtain the estimated A-weighted TWA under the ear protector.

This manual considers the effectiveness of any combination of insert plugs with circumaural muffs (double protection) to be at least 30 dB. If an activity determines the result of subtracting the estimated reduction value of a particular device or combination of devices from the measured workplace sound level is at or below 84 dB(A), the protection is adequate. However, should the value exceed 84 dB(A) or 140 dB peak, activities shall institute administrative controls to reduce personnel exposure to acceptable levels.

**Appendix 18-B**  
**Administrative Control of Noise Exposure**  
**with Hearing Protective Devices**  
**(Stay Time)**

Limiting time (hr:min per 24 hour day)

<u>Sound Level</u> <u>(dB(*))</u>	<u>Hearing Protector Noise Reduction (dB)</u>			
	<u>10</u>	<u>20</u>	<u>30</u>	<u>40</u>
90	16	--	--	--
94	8	--	--	--
98	4	--	--	--
102	2	11:18	--	--
106	1	5:39	--	--
110	0:30	2:49	16	--
114	0:15	1:25	8	--
118	—	0:42	4	--
122	—	0:21	2	11:18
126	—	—	1	5:39
130	—	—	0:30	2:49
134	—	—	0:15	1:25
138	—	—	—	0:42

NOTE: Values other than those given above may be calculated using the formula:

$$T = \frac{16}{2^{\left[\frac{L-80}{4}\right]}}$$

Where: T = time in hours (decimal)  
L = effective sound level in dB(A)

\* - Sound levels may be measured in either dB (A) or dB (C). However, as noted in Appendix 18-A, if dB (A) is used, the NRR must be reduced by 7 dB.

Intermediate values may be interpolated by adding or subtracting the decibel difference to the appropriate column.